

Chapter 1

Introduction

1-1. Purpose

This manual provides guidance for the design, fabrication, and inspection of spillway tainter gates, trunnion girder, and trunnion girder anchorage for navigation and flood control projects. Load and resistance factor design (LRFD) criteria are specified for design of steel components. Allowable stress design (ASD) criteria are provided in EM 1110-2-2105 and may be used only with prior approval of CECW-ET. Orthotropic shell, vertical framed, and stress skin-type tainter gates may be suitable in some locations but are not covered in this manual. Other types of control gates, including radial lock valves (reverse tainter valves) and sluice gates, may be referred to as tainter gates but also are not included in this manual.

1-2. Applicability

This manual applies to USACE commands having responsibility for Civil Works projects.

1-3. References

References are provided in Appendix A.

1-4. Distribution

This publication is approved for public release; distribution is unlimited.

1-5. Background

a. The previous version of this document was published in 1966, and since that time, design and fabrication standards have improved. Load and resistance factor design has been adapted by many specification writing organizations including American Institute of Steel Construction (AISC) (1994) and American Association of State Highway and Transportation Officials (AASHTO) (1994). In addition to the development and adoption of LRFD criteria, general knowledge on detailing and fabrication to improve fracture resistance of structures has advanced greatly. Most of the research and development behind current fatigue and fracture provisions of AISC, American Welding Society (AWS), and AASHTO were accomplished during the 1970's. EM 1110-2-2105 has been revised recently (1993) to include new LRFD and fracture control guidance for hydraulic steel structures.

b. Additionally, knowledge has expanded due to operational experience resulting in improved design considerations. During the late 1960s and early 1970s, many tainter gates on the Arkansas River exhibited vibration that led to fatigue failure of rib-to-girder welded connections. Study of these failures resulted in development of improved tainter gate lip and bottom seal details that minimize vibration. Tainter gates at various projects have exhibited operational problems and failures attributed to effects of trunnion friction not accounted for in original design. As a result of related studies, information regarding friction magnitude and structural detailing to withstand friction forces has been gained. Traditionally, tainter gates have been operated by lifting with wire rope or chains attached to a hoist located above the gate. More recently, hydraulic cylinders are being used to operate tainter gates due to economy, reduced maintenance, and advantages concerning operating multiple gates.

c. The intent for this publication is to update tainter gate design guidance to include the most recent and up-to-date criteria. General applications are discussed in Chapter 2. Guidance for LRFD and fracture control of structural components is provided in Chapter 3. Criteria for design of trunnion, gate anchorage, and trunnion is are given in Chapter 4 through 6. Considerations for operating equipment are discussed in Chapter 7. Chapter 8 provides general guidance on corrosion control. Appendix A includes references and Appendix B presents general design considerations and provides guidance on preparation of technical project specifications regarding fabrication and erection of tainter gates. Considerations for design to minimize operational problems are included in Appendix C. Appendix D provides data on existing tainter gates.

1-6. Mandatory Requirements

This manual provides design guidance for the protection of U.S. Army Corps of Engineers (USACE) structures. In certain cases guidance requirements, because of their criticality to project safety and performance, are considered to be mandatory as discussed in ER 1110-2-1150. In this manual, the load and resistance factors for the design requirements of paragraphs 3-4, 4-4, 5-4, and 6-4 are mandatory.